

ON THE ANATOMY AND SYNONYMY OF THE GENUS
MARIELLA, GRAY.

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PLATE IX.

SOME time ago our member, Mr. Oliver Collett, F.R.M.S., sent a number of slugs from Ceylon to the writer for description. One species amongst these, however, can be identified as having been described before upon more than one occasion, while it, or a nearly allied form, has, three or four times over, had a new genus specially created for its reception.

A rough anatomical investigation of one of the specimens under consideration revealed its relationship to the members of the genus *Girasia*, Gray, the structure of which has been investigated by Lieut.-Col. Godwin-Austen¹; and a reference to a manuscript list of Cingalese slugs kindly furnished by Mr. E. R. Sykes showed the occurrence of *Tennentia Thwaitesii*, Humbert, and *Vega Nordenskioldi*, Westerlund, in the island. These two last forms, with *Dekhania Beddomei*, Godwin-Austen, from the south-west of India, are put by Cockerell, in his "Check-List of Slugs,"² into the genus *Mariella*, Gray, the type species of which is *Mariella Dussumieri* (Valenciennes MS.), Gray, from Mahi. In a note³ Cockerell gives his impression that all the forms alluded to belong to the same species, and he must also be credited with having previously⁴ placed them in Gray's genus, but without giving the reasons in detail.

The material belonging to the British Museum (Natural History), which was examined through the courtesy of Mr. Edgar Smith, consists of Gray's type-specimen of *M. Dussumieri* and two examples from Ceylon labelled *Tennentia Thwaitesii*, Humbert, by Cockerell. There is no record of the last two slugs, though it is probable from the date upon the bottle (and from the fact that the Museum acquired other specimens procured by Thwaites) that they were collected by the man whose name they bear and are really the fellows of those described by Humbert.

¹ Proc. Zool. Soc., 1880, pp. 289-299; Land and Fresh-water Mollusca of India, p. 220, pls. xxiv-xxvi.

² Conchologist, vol. ii (1893), p. 186.

³ Tom. cit., p. 204.

⁴ Ann. & Mag. Nat. Hist., ser. vi, vol. vii (1891), pp. 103 & 104.

A comparison of the descriptions of *Mariella*¹ and *Tennentia*² with the specimens alluded to and with those sent by Mr. Collett, so far as the external characters and the shells went, was carefully made by the writer; but the opinion arrived at, with which Mr. E. A. Smith concurred, was that he could not conscientiously separate any one from the others. In like manner the figures and descriptions of *Vega Nordenskioldi*³ and *Dekhanianella Beddomei*⁴ were considered and compared with the forms already studied and with each other, and all were put down as generically, if not specifically, identical.

The only recorded point which could be taken as evidence against the idea that these should all fall into the same genus was the presence of a pinhole in the dorsal wall of the mantle in Godwin-Austen's species; this was also suggested by a tiny dark dot in Mr. Collett's specimens, while the presence of such an opening was either not mentioned, or stated to be not apparent, in the descriptions of the other 'genera.'

Against the supposition that all the forms belonged to the same species it might be objected (1) that Gray's species is recorded from "Mahi, near Sechelles," which is widely separated from Ceylon and southern India, where the other forms were found, and (2) that the size and general appearance of *Mariella Beddomei* suggest its possible distinctness.

The generic difficulty has been removed (except in the case of *Vega*), though it was only after the preserving fluid had been wiped off, and the minute spot focussed under a low power of the microscope, that a gentle squeezing of the body caused a tiny stream of liquid containing particles to issue from the dot and thus prove the existence of a pore in one of Mr. Collett's specimens; while a careful microscopical examination of the Museum specimens showed, to the satisfaction of Mr. E. A. Smith and the writer, the presence of a similar pore in the mantle of these slugs.

Since the greater part of this paper was written, a note by Mr. Cockerell has appeared,⁵ in which he points out that there is a place called Mahé, which is a French colony on the south-west (he says south-east) coast of India, not far from the Travancore Hills, whence came Godwin-Austen's species. The Seychelles are expressly mentioned by Gray, and further evidence must be forthcoming with regard to the travels of M. Dussumiers, who collected the type, before Mr. Cockerell's contention can be allowed. It might further be pointed out that the locality as given in the British Museum's register is simply Mahi. There is at least one place of that name to the north-west of India, and though the writer has not been able to trace M. Dussumiers to the Seychelles, the late Dr. Crosse kindly wrote to

¹ Catalogue of Pulmonata in Brit. Mus., pt. i (1855), p. 62.

² Rev. & Mag. Zool., 1862, p. 427, pl. xvii, figs. 1a & 1b.

³ Vega Exped., vol. iv (1887), p. 188, pl. ii.

⁴ Land and Fresh-water Mollusca of India, pt. vi (April, 1888), p. 242, pl. lviii.

⁵ Nautilus, vol. xii (1898), p. 9.

say that this traveller presented several living wild animals, including a tiger, to the Paris Museum, which points to his having visited India.

If Gray's locality were right, and any important points of difference could be made out between his species and the Cingalese forms, there might be some hesitation before placing *M. Thwaitesii* and *M. Nordenskioldi* as synonyms of *M. Dussumieri*, to which Mr. Collett's specimens must also be referred. But no differences of body or shell can be determined, and the internal organs of the unique original specimen cannot well be examined.

The occurrence of *Mariella* in Ceylon, southern India, and the Seychelles, that is, in the Cingalese district and the Malagasy region, seems to be regarded by Mr. Cockerell¹ as an anomaly in distribution, but it can be looked upon as one more point in favour of the theory now gaining ground² that a more or less uninterrupted land connection formerly existed between these various localities.

That a species may have remained undifferentiated even in places so far remote as Mahé and Ceylon, is possible; and under the existing circumstances the specific name *M. Dussumieri* must stand for both Cingalese and Seychelles forms; but if at some future time there be reason for separating the examples from Ceylon the name *M. Thwaitesii*, Humbert, must be retained for them.

Through the kindness of our President, Lieut.-Col. Godwin-Austen, the writer has been enabled to examine the original specimens and preparations of *M. Beddomei* and to dissect another example. Some differences in the genitalia, other than those of size, were made out, which will be alluded to later on, and which are considered sufficient to separate this as a distinct species.

BIBLIOGRAPHY AND SYNONYMY OF THE GENUS.

In 1855 Gray constituted the genus *Mariella*³ (*Clypeidella*, Valenciennes MS., non *Clypidella*, Swainson), with the following characters and containing *M. Dussumieri* from Mahi:—

“Mantle or body convex, produced like a fleshy collar in front, swollen behind, and separated from the upper part of the foot, in a cavity of which it lies, fringed on the side. Foot compressed, truncated, and with an elongate perpendicular gland behind. Shell quite hidden by the mantle, half ovate, solid, with a thin, horny, more or less expanded edge.”

In the description of the type species it is further stated that “the mantle is smooth above, with three slight keels on the hinder part, the central one the largest and most distinct, back without the slightest appearance of a hole.”

It will be noted that there is no express statement in the generic description as to whether the term “fringed on the side” refers to the mantle or to the body, but a glance at the type at once shows that

¹ Nautilus, vol. xii (1898), p. 10.

² Cf. Günther, Proc. Linn. Soc. London, Oct. 1898, p. 22.

³ Cat. Pulmonata in Brit. Mus., pt. i (1885), p. 62.

if either be intended it is not the former: this is of interest with reference to Humbert's genus.

The shell of a specimen from the same locality was afterwards figured by Fischer in 1856,¹ and placed in the genus *Viquesnelia*, Deshayes (created for a fossil shell), under Valenciennes' manuscript name.

Humbert² next, in 1862, described a new genus *Tennentia* to contain a Cingalese slug *T. Thwaitesii*, practically identical with the first mentioned, on the strength of the fact that the mantle was "entire, not fringed." The description is much fuller than Gray's, being accompanied by figures of animal, shell, jaw, and radula, but the only further point of historical interest is the statement that the respiratory opening is in a notch "in the middle of the right side of the mantle."

The Vega Expedition brought home from Ceylon a slug which Westerlund³ in 1887 differentiated under the name of *Vega Norden-skioldi*. The old fallacy about the "fringed mantle" again prevented the form described from being placed in *Mariella*; an additional reason for separating the new form from the latter being the absence of a fleshy 'collar.' From Humbert's *Tennentia* the Vega's slug differed, it was supposed, in having the respiratory orifice not in the middle, but anteriorly placed on the right side of the mantle. An examination of the figure brings out the fact that the free portion of the mantle which forms the collar is shown, but that it, as well as the head, is contracted, and hence it follows that the position of the respiratory opening must necessarily lie nearer to the anterior end of the body and mantle than when the slug is more extended.

The other differences between *Vega* and *Tennentia* are based apparently upon Semper's⁴ description of *Tennentia Philippinensis*, but since the anatomy of that animal differs very markedly from *Mariella*, in the spermatheca being sessile (showing a relationship to *Parmarion*) and in the central tooth of the radula being absolutely unlike that of the former genus, the arguments based upon it can have no weight in the present discussion.

In 1888 Godwin-Austen⁵ made a new subgenus of *Girasia*, Gray (= *Helicarion*), to wit, *Dekhania*, afterwards raised to generic rank,⁶ to contain a form (*D. Beddomei*) shown to be generically identical with *Mariella* by its external characters, jaw, and radula.

A brief description is given and allusions made for the first time to the anatomy of the soft parts, the genitalia being described as "like those of *Girasia* save that the amatorial organ (dart sac) is not so large." The anatomy of the latter genus was previously described by Godwin-Austen,⁷ therefore no detailed account is given

¹ Journ. de Conch., 1856, p. 290, pl. vii, fig. 18.

² Rev. & Mag. Zool., 1862, p. 428, pl. xvii, fig. 1.

³ Vega Exped., vol. iv (1887), p. 188, pl. ii, figs. 1a & 1b.

⁴ Reisen Archipel Philippinen, vol. ii (1870), pt. iii, p. 7.

⁵ Land and Fresh-water Mollusca of India, p. 242, pl. lviii.

⁶ Op. cit., p. 253.

⁷ Proc. Zool. Soc., 1880, p. 293, pls. xxiv, xxv.

in the "Land and Fresh-water Mollusca of India," though the genitalia of *Girasia Radha*, G.-A., are figured, and it is stated that those of *G. Hookeri* are, with certain restrictions, in every way similar to those of *Austenia gigas*. The anatomy of *Mariælla*, as made out in Mr. Collett's specimens, agrees with that of *Dekhania*, so far as indicated by Godwin-Austen.

It now remains to give revised descriptions of the genus *Mariælla* and its two valid species *M. Dussumieri* and *M. Beddomei*, with some account of their anatomy.

MARIÆLLA, Gray.

Mariælla, Gray: Cat. Pulmonata Brit. Mus., pt. i (1885), p. 62.

Tennentia, Humbert: Rev. & Mag. Zool., 1862, p. 427, pl.

Vega, Westerlund: Vega Exped., vol. iv (1887), p. 188, pl. ii.

Dekhania, Godwin-Austen: Land and Fresh-water Mollusca of India, pt. vi (April, 1888), p. 242, pls. lvii and lxii.

Animal limaciforme, antice convexum, crassum, semicylindricum; postice post medium angustum, valde compressum, dorso acute carinatum, ad finem pedis peroblique truncatum (truncatura superne verticali, deinde valde declivi) et glandula mucosa terminatum. Pallium ovatum, plus minusve tricarinatum, antice, liberum, postice, in loculamento pedis subquadrato depressum et ad medium perforatum; super carinam unam cicatrix a foramine parvo, ad scissuram in margine dextro currit ubi orificium respirationis ponitur: margo posterior scissuræ sub aliam productus. Pes canaliculo angusto et lineolis fuscis notatus. Solea obscure tripartita, orificium genitale commune post tentaculum dextrum positum.

Cochlea interna, subovata, superne convexa et cute protecta, inferne vel concava vel calce completa et convexa; apex posterior, in margine dextro et desuper versus.

Viscera in pedem post pallium non producta. Maxilla simplex, in medio elevata. Dens centralis et dentes radulæ laterales plus minusve tricuspidati, dentes marginales pæne æque bicuspidati. Genitalia—sacculus spiculi amoris præsens, oviductus liber, turgidus. Penis acute flexus ubi appendix retractorem portans emergit; epiphallus in flagellum breve productus.

This slug (Pl. IX, Figs. 1-1a) is characterized by having a more or less oval mantle, which is free and capable of some amount of extension in front and which covers the viscera behind. The posterior end of this mantle is tucked into a pocket (which has a somewhat square termination) beneath the keel on the hinder portion of the foot. The 'tail' is also laterally compressed, truncated, and bears a slit-like mucous gland at its extremity. Three keels are at some stage more or less strongly developed on the surface of the mantle, and a special feature is the tiny hole in the mantle wall in the middle line posteriorly, while a scar runs from this orifice

to a slit in the right border of the mantle, marking the line of junction between the right and left shell lobes which are still free in the genus *Macrochlamys*. The posterior margin of this slit extends forwards, and is overlapped by the anterior one. The common genital orifice is situated behind to the right tentacle. The foot has a narrow pedal groove, and is marked at its edge with dark lines, while the sole shows some slight traces of differentiation into three portions.

The shell (Pl. IX, Figs. 2-2a) is to all intents and purposes internal, and is somewhat oval in shape, with a light-coloured periostracum, it is convex above, while on the under side either the original hollow may remain or this may be filled up with shelly matter, even to the extent of rendering the under surface convex. The lines of growth are well marked, and the apex of the shell, which lies on the right side of the posterior end, is directed downwards. An important point is that the viscera are not carried behind the mantle into the foot. The jaw (Pl. IX, Fig. 3) is a simple structure, with a prominence in the middle; while the radula shows a central tricuspid tooth flanked by laterals, with large meso-cones, distinct ecto-cones, and ento-cones (Pl. IX, Fig. 4) that may be but barely distinguishable; the typical marginals (Fig. 4a) follow after a larger or smaller number of transitional teeth, and are bicuspid, the meso- and ecto-cones being practically equal in size.

The genitalia (Pl. IX, Fig. 5) seem to be very much like those of *Girasia* as described by Godwin-Austen. A dart sac is present, shown on the right-hand side in the figure; a swelling of the free oviduct takes place that appears to be characteristic; the penis, as in the last-named genus, is sharply bent at the point where an appendix bearing the retractor muscle is given off; an epiphallus follows which is prolonged as a blunt and short flagellum beyond the insertion of the vas deferens. The spermatophore (capreolus), so far as it could be made out in *M. Dussumieri*, is shown in Fig. 6; in the spermatheca there were some seven or eight of the shafts without projections; a bunch of these latter was, however, discovered attached to a broken head, and the two have been combined in Fig. 6, to give as correct a representation of the structure as possible.

This genus is evidently very nearly allied to *Girasia*, but differs in the following characters, as pointed out by Godwin-Austen when instituting the synonymous genus *Dekhania*. The depression in which the visceral hump is sunk is squarish, not V-shaped; the pedal grooves are not so deep nor so well shown, and the segmented margin is narrower; the orifice in the mantle is much smaller, as also is the shell, which is reduced, while the radula has a larger number of teeth in each row.

The question as to the dart sac being larger must, one would think, apply to girth,¹ since that of *Mariella Beddomei* seems comparatively larger than that of *Girasia Radha*, while that of *Mariella Dussumieri*

¹ During the reading of this paper Lieut.-Col. Godwin-Austen signified that this was what was meant.

is smaller in every respect. The teeth of the radula in the last-mentioned species resemble those of a typical *Girasia* rather than those of *Mariella Beddomi*, which, on the whole, seems the more nearly related to *Girasia*.

MARIELLA DUSSUMIERI (Valenc. MS.), Gray. Pl. IX, Figs. 1-6.

Mariella Dussumieri, Gray: Cat. Pulmonata Brit. Mus., pt. ii (1855), p. 63. (No fig.)

Viquesnelia Dussumieri, Gray: Fischer, Journ. de Conch., 1856, p. 290, pl. iii, fig. 18.

Tennentia Thwaitesii, Humbert: Rev. & Mag. Zool., 1862, p. 42, pl. xvii.

Vega Nordenskiöldi, Westerlund: Vega Exped., vol. iv (1887), p. 190, pl. ii, fig. 1.

Animal lateribus corporis fulvis, antice unicolor, post pallium nigro-striatum; pallium flavidum nigro-maculatum, valde tricarinatum. Cochlea, non per foramen minutum pallii visa sed apex per pallium conspicuus. Solea pedis albida. Maxilla longitudinaliter et distincte striata. Dentes radulæ laterales valde tricuspidati, in marginales celeriter mutantes. Spermatheca sacculo spiculi amoris longior. Long. (in Formaldehyde) 26, diam. 9 mm.¹

Hab.—Mahi and Ceylon.

This is the type species, for one must exclude the *Limax infumatus* figured, but not described nor localized, by Férussac, which has been suggested as a possible member of the genus.

The ground colour is yellowish-brown, becoming more yellow on the surface of the mantle, which is marked with dark blotches, while dark lines occur upon the sides of the foot behind the mantle. The foot-sole is whitish, the pore in the mantle minute and not easily discovered in spirit specimens. The surface of the mantle bears three distinct keels, that on the foot being light-coloured. The shell in all the specimens and figures seen by the writer is thin and concave, but Fischer says that it becomes filled up as in the next species. The jaw is distinctly striated longitudinally; the central and lateral teeth of the radula have large meso-cones and well-developed, pointed ecto- and ento-cones; the last-named are soon lost, and the teeth, as one passes towards the edges, quickly change into typical bicuspid marginals, in which the ecto- and meso-cones are practically identical in size, so that each tooth much resembles a serpent's tongue.

The dart sac is much shorter than the spermatheca and comparatively small.

The localities for this slug are Mahi (Dussumiers) and the Botanic Gardens at Peradeniya, Ceylon, under stones with *Veronicella* (Thwaites); Point de Galle (Vega Expedition); Watawala, November, 1896 (with *Veronicella*), 3,600 feet; and Ambegamuwa District, Central Province

¹ The Mahi type is 26 × 7 mm. The largest of the Museum specimens labelled *M. Thwaitesii* is 21 × 6 mm., while the one from which the dissection was made was rather larger than that of which the measurements are given above.

(Collett). A specimen has also been received from Kegalla through the kindness of Mr. Hugh B. Preston.

MARIELLA BEDDOMEI, Godwin-Austen. Pl. IX, Fig. 7.

Dekhania Beddomei, Godwin-Austen: Land and Fresh-water Mollusca of India, p. 242, pl. lviii.

Animal corpore silaceo, unicolori, vel maculato (ut in specie priore) vel omnino nigro. Pallium adulti indistincte tricarinatum. Cochlea per foramen pallii (in exemplis spiritu conservatis) non per pallium visa. Solea pedis flavescens. Maxilla vix striata. Dentes radulae laterales vix tricuspidati, in marginales lente mutantes. Spermatheca sacculo spiculi amoris brevior. Long. (in spiritu) 51, diam. 13 mm.

Hab.—Travancore Hills, South-West India.

This may be differentiated from the previous species by its much greater size and the comparatively larger orifice in the mantle: the mantle keels, though present in the younger examples, become indistinct on the adults. The colour is either uniformly ochreous, or this is dotted with black blotches all over the mantle and on the sides behind it, while one wholly black specimen is recorded and figured by the original describer. The keel on the foot was found with one exception to be dark-coloured. The shell appears to be, comparatively, somewhat narrower than in *M. Dussumieri*, and is convex below, the original hollow being filled up; while the longitudinal striation of the jaw is not so well marked as in that form. The central tooth of the radula is tricuspid; the marginals have a step-like ecto-cone, a large meso-cone, and hardly any apparent ento-cone: the transition into typical laterals is much more gradual, as might be imagined from the fact that the ecto-cones are much less strongly developed to begin with than in the last species, and consequently it takes a larger series to reach the more uniformly bicuspid type; in fact, in but few of these does the ecto-cone exceed the meso-cone in size.

The dart sac (Pl. IX, Fig. 7) is more elongated than in the other species, and is longer than the spermatheca, while the swelling of the free oviduct is more marked.

With respect to the so-called *Tennentia Philippinensis*, Semper, already spoken of, and two other species recently described from the Philippines under the same generic name, viz., *Mariella carinata*, Mildf., and *M. Quadrasi*, Mildf., Mr. W. E. Collinge says that Dr. von Möllendorf writes to him — "I have my doubts if all three really belong to *Tennentia*."

Under these circumstances, and taking into consideration the fact that the two latter 'species' were described¹ in a dozen lines or so, without figures, from external examination of single specimens, the writer does not at present feel justified in including them in the list of valid species of *Mariella*.

¹ Nachr. Malak. Ges., 1894, p. 85.

